BACKGROUND OF THE INVENTION

The present invention relates to a novel [[new]] type of dental handpiece.

Previously disclosed dental handpieces are of two types; [[,]] straight handpieces and contra-angle ~~counter-angled~~ handpieces.

In the case of contra-angle ~~counter-angled~~ handpieces, the body of the handpiece is comprised ~~consists~~ of a handle exhibiting an elbow and a ~~head.~~

~~This structure~~ head. This results in an embodiment which requires at least two parts for the body, and very often three parts, ~~in order~~ to permit the assembly of the internal components of the handpiece. This [[,]] ~~which~~ also requires a plurality of bearings; [[,]] at least three in ~~number.~~

~~It~~ number. It will be appreciated that this type of design does not permit a reduction in costs to any significant degree.

It is, therefore, an ~~A first~~ object of the present invention [[is]] to provide ~~propose~~ a novel ~~new concept for the~~ structure for [[of]] handpieces that is capable of replacing the current ~~concept of~~ handpieces, and which permits the production of the body in a single piece, whether for handpieces that are driven by mechanical means or for handpieces that are driven by an air turbine.

SUMMARY OF THE INVENTION

This object is achieved in accordance with [[by]] the present invention by providing [[,]] ~~which consists of~~ a dental handpiece of a [[the]] type comprised of ~~comprising~~ mechanical components, in particular a tool-holder assembly for the attachment and for the rotational driving of a dental instrument about a drive axis, and an assembly for the transmission of desired movement. The [[, said]] mechanical components are [[being]] mounted in the interior of a body having a head and a handle. The [[,]] ~~characterized in that the~~ body is formed from a single piece, forming [[or]] an envelope. One [[,]] ~~of which one~~ part of the body serves as a handle, and the other part of the body constitutes a head. The [[,]] ~~which~~ head includes ~~comprises~~ a first housing which opens out, ~~opening out~~ with at least one opening [[so]] dimensioned [[as]] to permit [[the]] introduction of the component parts of the head and their assembly in the interior of the body. The ~~latter, which~~ handle includes ~~comprises~~ a second longitudinal housing having a rectilinear axis which ~~and opening out~~, on the one hand, opens out at the extremity of the handle via an opening and which, on the other hand, opens out in the first housing via a lateral opening. The [[,]] ~~which~~ opening at the extremity of the handle is [[so]] dimensioned [[as]] to permit [[the]] introduction of the internal component parts of the handle, and their assembly in the interior of the handle ~~latter~~.

In an alternative ~~accordance with a variant~~ embodiment, the handpiece includes an ~~comprises~~ electrical connection [[means]] constituted by a chain of component parts for the mechanical transmission of [[the]] rotational movement, to assure ~~assuring~~ the transmission of appropriate [[the]] movement, and for the conduction of electrical energy from a connection provided at the extremity of the handle [[,]] (for ~~in order to~~ interacting with an external motor) [[,]] and as far as the ~~instrument.~~

~~In accordance with another~~ instrument. In one variant, the ~~it comprises~~ electrical connection is [[means]] constituted by a conducting ~~wire.~~

~~In accordance with~~ wire. In another variant, the electrical connection is ~~it comprises~~ an elastic connection component for ~~the purpose of~~ providing an electrical connection between the component parts of the mechanical transmission ~~component parts~~ and the head of the tool.

In another alternative embodiment ~~accordance with another variant~~, the head contains a turbine, and the body of the handpiece includes ~~comprises~~ fluid channels that are necessary for its function.

The interior housing of the head is preferably [[so]] adapted [[as]] to receive a tool-holder assembly comprised ~~composed~~ of mechanical transmission component parts of the head, and [[as]] to receive a means for [[of]] tightening and releasing the tool or the instrument. The [[, said]] housing opens ~~opening~~

out onto the head via an opening that is closable by ~~means of~~ a stopper or a cap, or by ~~means of~~ a push-button.

The handpiece preferably comprises an arrangement for the attachment of a dental instrument to the [[a]] tool-holder assembly, for the attachment and rotational driving of a dental tool or instrument about a driving axis. The [[, said]] tool-holder assembly is [[being]] integrated into the [[a]] head of the [[a]] dental handpiece, and is connected to a transmission [[an]] assembly ~~for the transmission of movement~~ integrated in the [[a]] handle of the [[said]] handpiece, and is ~~composed~~ principally comprised of a deformable and elastic ~~means of~~ tightening and releasing means in the form of a belt. At [[,]] ~~of which at~~ least one part of the belt has ~~exhibits~~ a section adapted for [[to]] engagement in a groove or an annular slot ~~that is~~ provided in the upper part of the instrument, and is adapted to retain the [[said]] instrument by tightening on [[of]] the instrument. The [[,]] ~~said means of~~ tightening and releasing means also includes ~~comprising~~ means for the application of releasing forces for canceling such [[the]] tightening forces, for the purpose of releasing the ~~instrument.~~

~~Said~~ instrument. The foregoing attachment arrangement is preferably detachable from ~~in relation to~~ the tool-holder.

In ~~accordance with~~ one variant, the belt is made of a deformable, elastic material, and exhibits a form that is essentially that of a parallelogram having a central zone which is provided for the purpose of retaining the head of

the instrument tightly in place at the level of a ~~slot.~~

~~In accordance with~~ slot. In another variant, the elastic, deformable belt exhibits the form of a split ring or a split annular clip including ~~comprising~~ an annular shoulder [[so]] adapted for engagement ~~as to engage~~ in an annular slot in the instrument, and a conical part for ~~intended to~~ interacting with a complementary conical part of a push-button.

Depending upon ~~In accordance with~~ the embodiment employed ~~execution variant~~ and/or the operating speed of the tool, the attachment arrangement can include ~~may comprise~~ a push-button. The push-button [[,]] ~~which~~ may or may not be integral with the tool-holder, and can [[may]] be ~~capable of being~~ retained [[,]] ~~for example by clipping,~~ in an opening in the head, for example, by clipping.

Further ~~The invention will be appreciated more easily with the help of the~~ description of the present invention is provided below, ~~in conjunction~~ with [[which] reference ~~is made~~ to the following drawings. ~~accompanying Figures:~~

BRIEF DESCRIPTION OF THE DRAWINGS

[[-]] Figure 1 is an isometric [[:]] ~~a general~~ view ~~in three dimensions~~ of a handpiece produced in accordance with the present invention. [[,]]

[[-]] Figure 2 is [[:]] a ~~view as a~~ longitudinal section of the handpiece shown in Figure 1. [[,]]

[[-]] Figure 3 is [[:]] a ~~view as a~~ partial longitudinal section of an ~~non restrictive~~ embodiment of the present invention. [[,]]

[[-]] Figure 4 is an isometric view of [[:]] a ~~three dimensional representation and a~~ partial section of another ~~non restrictive~~ embodiment of the present invention, having ~~comprising~~ a ~~means of~~ tightening and releasing means in the form of a lozenge-shaped elastic belt which is capable of being released manually. [[,]]

[[-]] Figure 5 is [[:]] a view of [[as]] an axial section of the view shown in Figure 4. [[,]]

[[-]] Figure 6 is [[:]] a ~~view as a~~ partial transverse section of the head shown in Figure 4, illustrated at the level of the elastic belt. [[,]]

[[-]] Figure 7 is an isometric view, shown in [[: a]] ~~three dimensional representation and a~~ partial section, of the head shown in Figure 4. [[,]]

[[-]] Figure 8 is [[:]] ~~a view as~~ an axial section of another ~~non restrictive~~ embodiment of the present invention, having ~~comprising~~ a ~~means of~~ tightening and releasing means in the form of an elastic belt capable of being released by the actuation of a push-button. [[,]]

[[-]] Figure 9 is an isometric view, shown in [[: a]]

~~three dimensional representation and a~~ partial section, of the embodiment shown in Figure 8. [[,]]

[[-]] Figure 10 is an isometric view [[: a]] ~~three dimensional representation~~ of the elastic belt shown in Figures 8 and 9. [[,]]

[[-]] Figure 11 is [[:]] ~~a view as~~ an axial section of another ~~non restrictive~~ embodiment of the present invention, having ~~comprising~~ a ~~means of~~ tightening and releasing means in the form of a split ring. [[,]]

[[-]] Figures 12 and 13 are isometric views [[: a]] ~~three dimensional representation~~ of the push-button shown in Figure 11. [[,]]

[[-]] Figures 14 and 15 are isometric views [[: a]] ~~three dimensional representation~~ of a ~~means of~~ tightening and releasing means in the form of a split annular clip, as shown in Figure 11. [[,]]

[[-]] Figure 16 is an isometric view [[: a]] ~~three dimensional representation~~ of a push-button, as shown in Figure 3. [[,]]

[[-]] Figure 17 is a sectional view of an alternative of the [[:]] ~~a variant~~ embodiment shown in [[of]] Figure 3, having ~~comprising~~ an elastic and conducting connecting ~~connection~~ component part.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

General concept of the body of the handpiece[[.]]

Reference is first made ~~in the first instance~~ to the non-restrictive examples of the present invention shown in Figures 1 to 3.

In this embodiment, a [[A]] handpiece (1) ~~in accordance with the invention consists of~~ includes a body (2) formed as [[in]] a single piece. One ~~comprising one~~ part of the body (2) serves ~~serving~~ as a handle (3) having a rectilinear axis, and another [[one]] part of the body (2) constitutes ~~constituting~~ a head (4) [[,]] for the attachment and driving of an instrument (5) about ~~as claimed in~~ a driving axis (6). The driving axis (6) is capable of being aligned with the axis (7) of the handle, or is capable of forming a predetermined angle with the axis (7) of the handle which lies ~~latter, lying~~ between 90 and 180°, and preferably [[lying]] between 100 and 130°, as illustrated in the non-restrictive examples shown in the various figures.

The body is formed by an envelope (8), or external casing. The envelope (8) can [[,]] ~~which may or may not~~ be formed in a single piece, or in multiple pieces, and can ~~which may~~ be electrically insulating. The envelope (8) can ~~and capable~~, for example, be ~~of being~~ produced in a polymeric, thermoplastic or thermosetting material (preferably polyether-ether ketone, abbreviated to PEEK in the ~~rest of the~~ text which follows), and incorporates ~~incorporating~~ the

mechanical component parts of the handle and the head, together with electrical connection means. This then ensures [[,]] ~~ensuring the~~ transmission of the movement and the electrical energy from a connection (9) provided at the extremity of the handle, for ~~in order to~~ interacting with an external motor (not shown) [[,]] ~~not illustrated here~~, as far as the instrument (5) secured in the head (4).

The contra-angle ~~counter-angle~~ handpiece (1) shown ~~in accordance with the invention represented~~ in Figures 1 to 3 exhibits two axes (6) and (7). This leads to ~~enabling~~ the potential for friction inherent in each bearing to be limited in order to guarantee the most stable possible output. For this [[,]] ~~for which~~ reason, ~~in this case,~~ ball bearings are in this case also integrated in the envelope (8). Such an [[An]] arrangement of the contra-angle ~~counter-angle~~ handpiece ~~of this kind~~ lends itself particularly well to root canal treatments (endodonty) with an apex locator.

The [[A]] handpiece of ~~in accordance with~~ the present invention, when ~~that is~~ connected and coupled to a motor, may thus, for example, produce ~~generate~~ a rotational movement in [[to]] an instrument (5) (a root canal instrument, for example), as well as ~~and by this means may even~~ convey an electric current that is capable of being utilized for the detection of the apex. The electrical connection between the motor and the handpiece (see Figures 2 and 3) can [[may]] be effected by any connection [[means]], for example, between an attachment hook for the motor

and an attachment groove (10) of a socket (11) (or by means of a telescopic button, for example). The envelope (8), which is insulating, is held by the practitioner in his hand, and the [[its]] extremity at the head (4) [[end]] is placed in the patient's mouth.

In the ~~mouth. In this~~ configuration shown, the chain of mechanical transmission and electrical component parts is constituted as follows. Inside ~~inside~~ the handle, [[: the]] electrical current passes from the socket (11) to a fixed external race of a first bearing (12), then [[and]] to a first spring (13), then to a fixed external race of a second bearing (14), then to a ring (15) that is retained axially on a first shoulder in the envelope (8), and then to a spring (16) that is retained axially by a second shoulder of the envelope ~~(8).~~

~~The~~ (8). The first and second bearings (12, 14) support a transmission shaft along the longitudinal axis (7) of the handle, or the first axis of the handpiece (1). The [[,]] ~~and the~~ springs (13, [[and]] 16) are compression springs having ~~of which the~~ coils that are arranged externally to the transmission shaft ~~(7).~~

~~At~~ (7). At this stage, the electrical current has [[thus]] crossed the handle [[part]] of the contra-angle, ~~counter-angle~~ or the handpiece (1).

As an alternative ~~variant~~, ~~it is possible to envisage~~ a conducting wire can run ~~running~~ from the extremity of the handpiece (1) which communicates with the motor ~~at the motor end~~

to the contact with the instrument or tool (5).

The head (4) of the contra-angle ~~counter-angle~~ handpiece, with its second axis or drive axis (6), supports two ball bearings (with oblique contact, if possible), namely an upper bearing (17) and a lower bearing (18). The [[,]] ~~of which the~~ external race of the upper bearing (17) interacts with the second spring (16) of the handle. Axial play in the [[,]] ~~and a~~ lower bearing (18) [[,]] ~~of which the axial play~~ is taken up with ~~the help of~~ an elastic washer ~~(19).~~

~~In~~ (19). In this type of bearing assembly, the balls of the bearings are in contact at all times with the external and internal races of the bearings ~~latter~~, thereby ensuring an electrical connection between fixed parts and moving parts.

A barrel pinion (20) is mounted on the drive shaft (6) and includes ~~comprises~~ teeth (21) engaging with the teeth (22) of an output pinion (23) of the ~~handle.~~

~~The~~ handle. The barrel pinion (20) is conductive and integral with the interior races of the bearings, and [[it]] ensures the conduction of electricity to the instrument (5), as well as [[and the]] mechanically driving [[of]] the instrument (5) ~~latter~~. The electrical current that is conveyed to the extremity of the instrument will delimit the apex through the effect of variation in the resistance, taking into account the external insulation of the envelope (8), and a push-button (55) provided on the head (4) which will be [[, as]] described in greater detail below.

As a variant, the electrical connection between the second bearing (14) and the head (40) of the instrument is provided ~~assured~~ by an elastic and electrically conducting connecting component (88). The [[, the]] mechanical drive for the instrument is again provided ~~being assured~~ by the barrel pinion (20), as ~~previously.~~

~~Said~~ previously described. The connecting component (88) can be [[is]] a strip, for example, or a bar of circular or rectangular section. A [[,]] ~~and comprises a~~ first peripheral segment (89) of the connecting component (88) is engaged in a slot (90) formed [[made]] in the race (15) of the bearing (14). A [[and a]] second peripheral segment (91) of the connecting component (88), at the opposite end of ~~extremity to~~ the first segment, [[which]] is supported against the head (40) of the instrument. The slot (90) maintains the [[, said]] connecting component ~~being maintained~~ perpendicular to the axis of the instrument when the push-button is not activated ~~inactivated, thanks to the slot (90)~~.

Use of the connecting component (88) ~~This variant~~ is particularly advantageous because, on the one hand, the support on the push-button (55) has a tendency to repel the head (40) of the instrument and because, on the other hand, [[the]] contact by the connecting component with the head (40) is centered on the axis of the instrument due ~~thanks~~ to the spherical surface of the [[said]] head, resulting in a ~~hence the~~ rate of friction which is close to zero.

Concept of the attachment arrangement and the means of tightening and releasing of the instrument in the head[[.]]

The following ~~What are described here~~ are preferred, and non-limiting ~~although not restrictive,~~ embodiments of [[a]] means for [[of]] attaching an instrument in the head (4) and for ~~their means of~~ tightening and releasing the instrument.

In the course of root canal treatment, for example, [[the]] accessibility of the molars must be [[is a]] guaranteed for [[of]] comfort and quality, both for the practitioner and for the patient. For this reason, the head of the ~~This is why the applicant has set herself the objective of proposing a~~ tool-holder assembly (24) of the present invention is comprised ~~composed~~ of mechanical transmission component parts ~~of the head~~ that are ~~should be~~ as small and compact as ~~possible.~~

~~The applicant has achieved her objective by conceiving:~~

[[-]] possible. This is achieved with a novel [[new]], compact ~~and not bulky means of~~ tightening and releasing means (25), which is not bulky and which is [[being]] part of the [[an]] attachment assembly.

The tightening and releasing means (25) includes [[,]] ~~and consisting of~~ a deformable and elastic belt (25) which can be made ~~or not made~~ of a plastic material (PEEK, for example), and which is itself capable ~~by itself~~ of assuring the functions of tightening and releasing. Releasing is [[,]]

~~said releasing being~~ performed by [[a]] centripetal manual action on the belt, and [[said]] tightening is [[being]] performed by relaxing this ~~action,~~

[[- an]] action. An internal housing (26) in the head is [[,]] adapted to receive the tool-holder assembly (24) and the ~~its means of~~ tightening and releasing means (25). The internal [[, said]] housing (26) opens ~~opening~~ out onto the head via an opening (27) that is capable of being closed by ~~means of~~ a stopper or a cap (28), or by ~~means of a push-button.~~

~~This~~ a push-button. Such a solution will be appreciated more fully from the description ~~readily by reading the descriptions~~ of the following two embodiments ~~given below~~.

A first alternative embodiment ~~mode of realization~~ is described ~~initially~~ in conjunction with Figures 4 to 7. Releasing is, in this embodiment, ~~for which releasing is~~ controlled by a direct manual action on the ~~belt.~~

~~According to the~~ belt. The housing (26) of the tool-holder assembly (24) includes ~~exhibits, on the one hand,~~ a lower, cylindrical part (29) that is coaxial with the driving axis (6) and [[of]] which has a [[the]] diameter [[is so]] adapted [[as]] to receive the barrel (30) of the barrel pinion (20). An [[,]] ~~and, on the other hand, an~~ upper, essentially

cylindrical part (31), is similarly coaxial with the driving axis (6) and has ~~having~~ a larger diameter. The cylindrical part (31) is provided ~~and intended~~ to receive the teeth (21) of the pinion barrel, with its means for [[of]] interlocking the instrument, as well as a ~~the device for~~ tightening and releasing device which is ~~the latter~~ described below.

The discharge opening (27) of the upper part of the housing (31) is closed by ~~means of~~ a stopper or cap (28) which is [[,]] preferably, although not necessarily made of the same material as the envelope ~~(8).~~

~~The~~ (8). The upper part of the housing (31) similarly has ~~comprises~~ a lateral opening (32) that discharges ~~discharging~~ into an internal housing (33) of the handle (3), ~~in such a way as~~ to permit the engagement of the teeth of the barrel pinion (20) with the teeth of the output pinion (23) of the handle (3).

The barrel pinion rotates freely in the head, and its axial standard is assured between, on the one hand, the base (34) of the upper part of the housing, which forms a shoulder, and [[,]] on the other hand, the frontal surface (35) of the stopper. The resulting axial freedom of the [[said]] barrel pinion is on [[in]] the order of a few hundred parts of a ~~millimeter.~~

~~The rotational~~ millimeter. Rotational movement of the output pinion (23) is transmitted to the barrel pinion (20), and then to the instrument (5), by ~~thanks to~~ a plane surface (36) which is provided on the instrument and interaction ~~interacting~~ with a plane surface (37) provided in the internal bore (38) of

the barrel pinion.

For the embodiment ~~As claimed in this example~~ of Figures 4 to 7, the ~~means of~~ tightening and releasing means is ~~composed~~ essentially [[of]] a belt (25) made of a deformable and elastic material which essentially exhibits the ~~exhibiting a~~ form ~~essentially~~ of a lozenge having a central zone (39). The central zone (39) is provided ~~in order~~ to retain the head (40) of the instrument securely in place at the level of an annular blocking slot (41) provided at the upper extremity of the ~~instrument.~~

~~The~~ instrument. The large diagonal of the lozenge is provided ~~in order~~ to ensure that its two extremities extend diametrically beyond the envelope of the head (4), as two projections (42), each located in a notch (43) in the head. The [[, each]] notch (43) ~~discharging~~, on the one hand, discharges into the upper part (31) of the housing and, on the other hand, discharges into the opening (27) receiving the stopper.

A direct, centripetal, manual action on the two projections (42) simultaneously brings about the release of the instrument, and the relaxation of this action assures the tightening of the ~~said instrument.~~

~~The~~ instrument. The flanges (44) of the notches (43) ensure [[the]] blocking against rotation of the belt, which is centered in the head by ~~means of~~ detachments (45) provided in [[the]] proximity to [[of]] the projections (42) and supported on the periphery (46) of the upper part of the housing (26).

The axial standard of the belt is assured, on the one hand, by a shoulder (47) provided in the base (48) of an axial cavity (49) of the stopper, for accommodating ~~intended to accommodate~~ the head (40) of the instrument, and [[,]] on the other hand, by the base (50) of the ~~notches.~~

~~In~~ notches. In this way, the belt does not touch the rotating part of the barrel pinion.

In the free state, the [[said]] belt interacts with an upper shoulder (51) of the annular slot of the head of the instrument in order to bring about a first axial limitation of the [[said]] instrument. A [[, the]] second axial limitation of the instrument is [[being]] assured by a plane surface (52) on the barrel pinion, which interacts ~~interacting~~ with a [[the]] transverse extremity (53) of the plane surface of the instrument.

Unlocking ~~The unlocking~~ of the instrument involves the application of two diametrically opposed pressing forces to the projections (42), which forces are directed toward ~~towards~~ the axis of rotation. These two forces give rise to an orthogonal component, thereby releasing the instrument. The act of ~~pressing~~ simultaneously and directly pressing on the two ears of the belt (with the thumb and index finger, for example) guarantees tightening at the mouth, as compared with a [[the]] push-button system, for example. Attachment of the instrument can be effected without applying pressure to the two ears of the belt due ~~thanks~~ to ~~the arrangement of~~ a conical part (64) which is provided on the undersurface of the central zone (39) in the

belt, in conjunction with ~~which the~~ axial displacement of the instrument which causes a radial displacement of the belt, by elasticity. The [[,]] ~~and the~~ belt then resumes its form ~~in order~~ to assure the tightening function.

A second alternative embodiment ~~mode of realization~~ of the ~~means of~~ tightening and releasing means is described [[below]] in conjunction with Figures 8 to 10.

The elastic belt (25), which has ~~having~~ the form of a lozenge and a central zone (39) for the purpose of securing the instrument, differs from the previously described ~~preceding~~ belt in ~~by the fact~~ that its ears (54) form projections perpendicular to the plane of the belt and are situated on the same side of the plane of the belt ~~as the latter~~, and because the belt ~~by the fact that it~~ is maintained in position axially and radially by the barrel pinion, as illustrated in Figures 8 ~~and 9.~~

~~To this effect :~~

[[-]] and 9. To this end, the two extremities of the belt cross two peripheral gaps (61) provided on the upper flange (62) of the barrel pinion, which are diametrically opposed and arranged on a plane transverse ~~transversal~~ to the driving axis ~~(6),~~

[[-]] (6), and the two ears (54) are blocked against rotation by two notches (63) on the ~~said flange.~~

~~Furthermore~~ flange. Furthermore, the head is distinguished from the previously described ~~preceding~~ head in ~~the sense~~ that the stopper is replaced by a push-button (55). The

push-button (55) has ~~having~~ a metallic insert, for example, [[(]] to facilitate its manufacture [[)]].

In this embodiment ~~As claimed in this mode of realization~~, the push-button ([[,]] made of PEEK for example) [[,]] includes ~~exhibits~~ a plurality of component ~~parts :~~

[[-]] parts. An [[an]] elastic ring (56) is provided at the lower extremity [[,]] which restricts the axial freedom of the barrel pinion and retains the push-button on the head ~~(4),~~

[[- an]] (4). An intermediate elastic zone (57) is provided [[,]] which plays the role of a return spring for the ~~push-button,~~

[[- an]] push-button. An internal cylindrical insert (58) is provided [[,]] which, when the push-button is pressed, permits the deformation of the elastic belt to be controlled, thereby releasing the tool. For [[,]] ~~and for~~ this purpose, pressing ~~a press~~ on the push-button (55) compresses its spring (57), causing ~~and causes~~ the internal conical form (59) of the insert (58) to interact with the complementary conical flanges (60) of the ears of the belt. The resulting radial component on the ears (54) of the belt induces another radial deformation perpendicular to the [[this]] primary radial component which [[.]] ~~This deformation~~ permits

unlocking of the instrument.

Introduction ~~The introduction~~ of the instrument into the head can [[may]] be effected by pressing on the push-button, or without pressing on the push-button. In the latter [[,]] ~~in which~~ case, a conical arrangement (64) on the undersurface of the central zone (39) of the belt permits the introduction of the ~~instrument.~~

~~The~~ instrument. The configuration of the belt contributes to being able to guarantee [[the]] tightening, through a centrifugal effect during rotation.

Concept of push-buttons

Miniaturization is [[a]] constantly sought ~~area of research~~ in the field of medical equipment, such as the heads of contra-angle ~~the counter angled~~ handpieces used in dentistry. New materials, such as thermoplastic or thermosetting polymer materials, help meet this need ~~challenge~~. Previously known ~~disclosed~~ mechanisms can [[may]] be reconsidered by taking into account the mechanical, physical and chemical characteristics of these new materials and, at the same time, by reducing the number of component parts. Improvements in [[,]] ~~improving the~~ quality and reductions in ~~reducing the~~ cost of the assembly are possible because the [[;]] ~~these~~ plastic parts can [[may]] be machined or injection molded ~~injected~~. In addition to miniaturization, ~~of course, these~~ such plastic materials also afford [[bring]] lightness, the ability to slide when used with [[for]] dynamic

equipment, high resistance to sterilization or disinfection, and favorable elastic characteristics. For these reasons, such ~~That is why these~~ plastic materials can be utilized in the production of dental handpieces.

The control ~~handpieces. The command~~ for tightening or releasing of the tool generally takes the form of the manual actuation of the push-button on the head of the handpiece. The ~~In accordance with the concept, this~~ push-button can [[may]] be integral with the dynamic assembly (rotating, vibrating, etc. [[...]]), for example, for endodonty, and can be [[with]] a fixed push-button independent of the dynamic assembly.

A head of a handpiece having a drill handle [[bur]] in place has previously ~~already~~ been illustrated, ~~presented above~~ as an example of one [[an]] application of the improvements of the present invention, with reference to Figures 2 and 3.

It is again ~~should be~~ pointed out ~~again here~~ that the body of the [[a]] head (4), whether or not unitary ~~in a single piece~~ with the handle (3), is fitted with a rotating barrel pinion (20) that is caused to rotate by an output pinion (23) in the handle. The barrel pinion possesses a freedom of rotation and an axial connection that are assured, for example, by ball ~~bearings.~~

~~It~~ bearings. It is, of course, possible to implement ~~envisage~~ solutions which do not ~~without the~~ use [[of]] ball bearings, as illustrated in Figures 5 and 7, having inserted slide [[plain]] bearings or having slide [[plain]] bearings

molded into the body of the head.

The transmission of [[the]] rotational movement for [[of]] the drill handle [[bur]] is assured by the cooperation ~~conjugation~~ of the plane surface (36) provided on the barrel pinion (20) [[(4)]] and the plane surface (37) of the tool. The axial standard of the tool is guaranteed [[,]] ~~in one sense,~~ by the shoulder on the plane surface of the barrel pinion and by the shoulder on the complementary plane surface of the tool.

For the various alternative embodiments previously described ~~Taking this common description as the starting point~~, it is possible to distinguish between two types of push-buttons that are useful in accordance with the present invention. [[,]] ~~namely:~~

[[-]] A [[a]] push-button integral with the dynamic assembly

Such a push-button, known as a [[the]] tool-holder, is illustrated ~~as indicated~~ in Figures 3 and 16 by the reference number ~~designation~~ (55), and ~~which solution~~ is characterized by permanent contact between a [[the]] rotating locking assembly and the push-button. In the state of rest, the push-button (55) (made from PEEK, for example) provides an axial limit for an elastic split ring (65) (also made from PEEK, for example) and, at the same time, centers the ring (65) ~~latter~~ in

relation to the axis (6). The ring (65) has an externally cylindrical form, and an [[its]] internal wall that includes ~~comprises~~ an upper flange with a conical gradient (71) and an intermediate part in the form of a transverse shoulder (66) directed toward ~~towards~~ the axis (6). The shoulder (66) of the ~~elastic~~ ring (65) retains the instrument (5) in the axial direction by engaging [[in]] the annular slot (41). The push-button (55) is guided radially in the bore (38) of the barrel pinion by one or more sectors or components (87) arranged on the undersurface of the push-button (55), [[and]] each terminated by a conical extremity for the purpose of pressing ~~providing the presses~~ on the elastic ring (65).

Axial ~~(65). The axial~~ displacement of the push-button (55) is limited between the upper and lower extremities of one or more gaps (68) made in the upper body of the barrel pinion. One [[,]] ~~and in which interact one~~ or more hooks (67) provided on the undersurface of the push-button can interact with the gaps (68). The ~~elastic~~ ring (65) applies an axial component to the push-button (55) to return it to its initial position. Due ~~Thanks~~ to their radial elasticity,

and due to slots (69) provided between the hooks and the sectors (87), the hooks (67) permit a [[the]] "clipping" engagement of the push-button in the barrel. Pressing ~~A press~~ on the push-button (55) permits unlocking of the tool (5) by means of the conical parts (70) which engage [[in]] the complementary conical gradient (71) of the elastic ring in order to disengage the shoulder (66). Introduction ~~The introduction~~ of the instrument (5) into the barrel pinion can [[may]] take place automatically, without the need to press on the push-button, due ~~thanks~~ to the conical part (73) provided on the undersurface of the elastic ring at the extremity of the shoulder ~~(66).~~

~~In~~ (66). In Figure 3, the ~~means of~~ tightening and releasing means is a split elastic ring that is open along a radial plane visible on the sectional plane shown in Figure 3, and the means for [[of]] applying the releasing forces are constituted by the conical gradient (71).

[[-]] A [[a]] push-button independent of the dynamic assembly

For applications ~~In the position~~ in which the tool is held in the practitioner's hand, ~~the solution is characterized by the separation of~~

the push-button and [[of]] the locking ~~means. An~~ means are generally separated. One such embodiment ~~of this kind~~ is illustrated by way of example in Figures 11 to 15.

In the state of rest, and whether or not in dynamic assembly ~~regime~~, [[and]] without actuation of the push-button, a conical, elastic annular clip (72) axially [[,]] retains the tool (5) via ~~axially thanks to its~~ arms (73) (for example, 6 arms), each of which is terminated by a shoulder (79) directed toward ~~towards~~ the axis (6). The clip (72) is integral with the rotating barrel pinion due ~~thanks~~ to the engagement of [[the]] peripheral projections (74) of the clip in corresponding openings (76) made in the barrel pinion. A ~~An entirely transcurrent~~ slot (77) completely traverses [[in]] the clips to permit ~~permits~~ the assembly and disassembly of the clip in the bore of the barrel pinion, thereby imparting the necessary radial elasticity [[to it]].

The push-button (55) is retained axially and is centered by elastic blades (75) cut into the [[its]] cap of the push-button, in the opening (27) in the head. The [[;]] ~~these~~ blades, when assembled under tension in the body of the head

[[body]], offer an elastic axial freedom [[(]] along the axis (6) of the push-button. Figures 12 and 13 illustrate the [[these]] blades (75) in a constrained ~~the constraint~~ position and show ~~exhibit~~ [[the]] clipping grooves (80) at the end of the blades for clipping the push-button (55) into the opening (27). A manual, axial pressing on the push-button is translated into an axial displacement of the conical base (78) of the push-button, which [[and it]] then interacts with the complementary cone (82) of the internal conical cavity of the arms (73) of the clip. Release [[;]] ~~releasing~~ of the tool is then assured by [[the]] separation of the ~~aforementioned~~ arms (73) and [[the]] disengagement of the shoulders (79). When [[the]] manual pressure on the push-button is released, ~~the push button resumes its initial position, as~~ the respective cones of the two component parts (55) and (72) are no longer in contact, and the push-button resumes its initial position.

In the embodiment of ~~accordance with this solution in~~ Figures 11 to 15, the ~~means of~~ tightening and releasing means is the elastic, conical clip (72), the shoulders (79) of which

are adapted to engage in the groove or annular slot (28) of the instrument. The [[,]] ~~and the~~ means for applying the releasing forces is constituted by the conical internal form (82) of the [[said]] clip (72), the radial deformation of which is ensured ~~guaranteed~~ by the slot (77).

Concept of greasing

With reference to Figure 8, which is an axial section through Figure 9, ~~and which shows that~~ the head includes a cavity (83) which is provided around, or to the side, of the barrel of the barrel pinion for the purpose of containing a solid grease. The solid grease [[that]] is released in a small quantity on each ~~occasion of~~ use ~~via an orifice (84) from the separating wall (85) between the cavity and the barrel~~ in order to lubricate the barrel. The solid grease is released from the separating wall (85) between the cavity and the barrel via an orifice (84).

Assembly concept

The envelope (8) can [[may]] be produced in a single piece by molding a plastic material (for example PEEK) [[,]] having electrically insulating properties, or a fritted material

containing metallic inclusions (for example Metal Injection Molding ~~Moulding~~, abbreviated to M.I.M.) [[,]] having electrically conducting properties, or any other material. The head of the [[This]] envelope includes ~~comprises :~~

[[-]] ~~in the head,~~ a first housing (26) for the attachment of a tool-holder and an instrument along the [[a]] drive axis (6). The [[,]] ~~which~~ housing (26) opens out to either side of the head via two openings. At [[,]] ~~of which at~~ least one of the openings, the opening (27), exhibits dimensions which ~~so adapted as to~~ permit the introduction of all of the component parts of the head, as well as their assembly, inside the head. A ~~handle, and a~~ second housing (33), having a rectilinear axis (7), on the one hand opens ~~opening~~ out ~~on the one hand~~ at the distal extremity of the handle via an opening (81), and ~~opening out~~ on the other hand opens out at the proximal extremity of the head. The second housing (33) opens into [[, in]] the first housing (26) via a lateral opening (32), permitting interaction between the mechanical components of the head and those of the handle. In addition, the opening (81) is dimensioned ~~in such a way as to be adapted~~ to permit the

introduction of all of the components of the handle, as well as their assembly in the interior of the second housing (33), ~~latter~~ along a rectilinear axis (referred to herein as the axis (7) of the handle).

To ~~(7). In order to~~ produce a contra-angle ~~counter-angled~~ handpiece, an envelope is provided in [[, of]] which the axes (6) and (7) [[(9)]] form, for example, an angle of between 90 and 180°, and preferably between 100 and 130°.

To [[,]] ~~and in order to~~ produce a straight handpiece, ~~it is possible to stipulate that~~ the axes (6) and (7) must be parallel and displaced from one another ~~in such a way as~~ to provide [[make]] an opening in the head (27) ~~available~~ for the assembly of the internal component parts, and for fitting the ~~fitment of a~~ stopper of a push-button.

The foregoing assembly [[This]] concept is particularly advantageous because it provides the possibility ~~of:~~

[[-]] of reducing the number of bearings, or completely eliminating the bearings, ~~them,~~

[[-]] reducing the cost of the ~~handpiece,~~

[[-]] handpiece, reducing the dimensions of the ~~handpiece,~~

[[-]] handpiece, facilitating cleaning (smooth ~~contours),~~

[[-]] contours) and improving hygiene (a single piece, and no interface).